PROJECT: **NCCWD**
**GYPSY HILL TANK**
Pacifica, California

# Log of Boring B5

PAGE 1 OF 1

Boring location: See Site Plan, Figure 2 | Logged by: DWA

Date started: 9/2/05 | Date finished: 9/2/05

Drilling method: B-24 6-Inch Flight Auger

Hammer weight/drop: 140lbs./30-inches | Hammer type: Automatic

| DEPTH (feet) | INFORMATION: SAMPLE TYPE | Sample | SPT[1] N-Value | LITHOLOGY | MATERIAL DESCRIPTION | LABORATORY TEST DATA: Type of Strength Test | Confining Pressure Lbs/Sq Ft | Shear Strength Lbs/Sq Ft | Fines % | Natural Moisture Content, % | Dry Density Lbs/Cu Ft |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Surface Elevation: 404+/- feet | | | | | | |
| 0 | | | | GP | GRAVEL (GP)<br>gray, loose, dry, 3/4"-1" gravel | | | | | | |
| 1 | | | | CL | LEAN CLAY (CL)<br>mottled brown, dark brown and yellow brown, stiff, moist, some fine sands, some angular rock fragments, gravels up to 1" diameter | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | MC | | 23 | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | SILTSTONE<br>mottled yellow brown, intensely fractured, low hardness, friable to weak, deep weathering | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | SPT | | 56 | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |
| 11 | SPT | | 60/6" | | | | | | | | |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | SPT | | 90 | | | | | | | | |
| 16 | | | | | EOH at 16 Feet | | | | | | |
| 17 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |

1. Elevations based on plan titled "Existing Conditions at Gypsy Hill Storage Tank", undated.
2. Groundwater not encountered during drilling.
3. Boring backfilled with cement grout.

Project No.: 105.005

Figure: A-5

Land/ Marine Geotechnics

| UNIFIED SOIL CLASSIFICATION SYSTEM | | | |
|---|---|---|---|
| **Major Divisions** | | **Symbols** | **Typical Names** |
| **Coarse-Grained Soils (more than half of soil > no.200 sieve)** | **Gravels** (More than half of coarse fraction > no. 4 sieve size) | **GW** | Well-graded gravels or gravel-sand mixtures, little or no fines |
| | | **GP** | Poorly-graded gravels or gravel-sand mixtures, little or no fines |
| | | **GM** | Silty gravels, gravel-sand-silt mixtures |
| | | **GC** | Clayey gravels, gravel-sand-clay mixtures |
| | **Sands** (More than half of coarse fraction < no. 4 sieve size) | **SW** | Well-graded sands or gravelly sands, little or no fines |
| | | **SP** | Poorly-graded sands or gravelly sands, little or no fines |
| | | **SM** | Silty sands, sand-silt mixtures |
| | | **SC** | Clayey sands, sand-clay mixtures |
| **Fine-Grained Soils (more than half of soil < no.200 sieve size)** | **Silts and Clays** LL = <50 | **ML** | Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts |
| | | **CL** | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays |
| | | **OL** | Organic silts and organic silt-clays of low plasticity |
| | **Silts and Clays** LL = >50 | **MH** | Inorganic silts of high plasticity |
| | | **CH** | Inorganic clays of high plasticity, fat clays |
| | | **OH** | Organic silts and clays of high plasticity |
| **Highly Organic Soils** | | **PT** | Peat and other highly organic soils |

| GRAIN SIZE CHART | | |
|---|---|---|
| **Classification** | **Range of Grain Sizes** | |
| | **U.S. Standard Sieve Size** | **Grain Size in Millimeters** |
| Boulders | Above 12" | Above 305 |
| Cobbles | 12 to 3" | 305 to 76.2 |
| Gravel | 3" to No.4 | 76.2 to 4.76 |
| coarse | 3" to 3/4" | 76.2 to 19.1 |
| fine | 3/4" to No.4" | 19.1 to 4.76" |
| Sand | No.4 to No.200 | 4.76 to 0.074 |
| coarse | No.4 to No.10 | 4.76 to 2.00 |
| medium | No.10 to No.40 | 2.00 to 0.420 |
| fine | No.40 to No.200 | 0.420 to 0.074 |
| Silt and Clay | Below No.200 | Below 0.074 |

## SAMPLE DESIGNATIONS/SYMBOLS

- Sample taken with Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter. Darkened area indicates soil recovered.
- Classification sample taken with Standard Penetration Test sampler
- Undisturbed sample taken with thin-walled tube
- Disturbed sample
- Sampling attempted with no recovery
- Core sample
- Analytical laboratory sample
- Sample taken with Direct Push sampler

| SAMPLER TYPE | | | |
|---|---|---|---|
| C | Core Barrel | PT | Pitcher Tube sampler using 3.0-inch outside diameter, thin-walled Shelby Tube |
| CA | California split-barrel sampler using 2.5-inch outside diamter and a 1.93-inch inside diameter | MC | Modified California split-barrel sampler with 3.0-inch outside diameter and a 2.43-inch inside diameter |
| D&M | Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube | SPT | Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter |
| O | Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby Tube | ST | Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure |

Land/ Marine Geotechnics

# SOIL CLASSIFICATION CHART

NCCWD Gypsy Hill Tank
Pacifica, California

Figure: **A-6**
Date: October 2005
Job Number: 105.005

## BEDDING OF SEDIMENTARY ROCKS

| | | |
|---|---|---|
| Very thick-bedded | Greater than 4.0 | Bed thickness in feet |
| Thick-bedded | 2.0 to 4.0 | |
| Thin-bedded | 0.2 to 2.0 | |
| Very thin-bedded | 0.05 to 0.2 | |
| Laminated | 0.01 to 0.05 | |
| Thinly laminated | less than 0.01 | |

## FRACTURING

| | | |
|---|---|---|
| Very little fractured | Greater than 4.0 | Size of pieces in feet |
| Occasionally fractured | 1.0 to 4.0 | |
| Moderately fractured | 0.5 to 1.0 | |
| Closely fractured | 0.1 to 0.5 | |
| Intensely fractured | 0.05 to 0.1 | |
| Crushed | less than 0.05 | |

## HARDNESS

| | |
|---|---|
| Soft | reserved for plastic material alone. |
| Low hardness | can be gouged deeply or carved easily with a knife blade. |
| Moderately hard | can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and is readily visible after the powder has been blown away. |
| Hard | can be scratched with difficulty; scratch produces little powder and is often faintly visible. |
| Very hard | cannot be scratched with knife blade; leaves a metallic streak. |

## STRENGTH

| | |
|---|---|
| Plastic | very low strength. |
| Friable | crumbles easily by rubbing with fingers. |
| Weak | an unfractured specimen of such material will crumble under light hammer blows. |
| Moderately strong | specimen will withstand a few heavy hammer blows before breaking. |
| Strong | specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments. |
| Very strong | specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments. |

## WEATHERING

| | |
|---|---|
| Deep | moderate to complete mineral decomposition, extensive disintegration, deep and thorough discoloration, many fractures, all extensively coated or filled with oxides. carbonates and/or clay or silt. |
| Moderate | slight change or partial decomposition of minerals, little disintegration; cementation little to unaffected. Moderate to occasionally intense discoloration. Moderately coated fractures. |
| Little | no megascopic decomposition of minerals; little or no effect on normal cementation. Slight and intermittent, or localized discoloration. Few stains on fracture surfaces. |
| Fresh | unaffected by weathering agents. No disintegration or discoloration. Fractures usually less numerous than joints. |

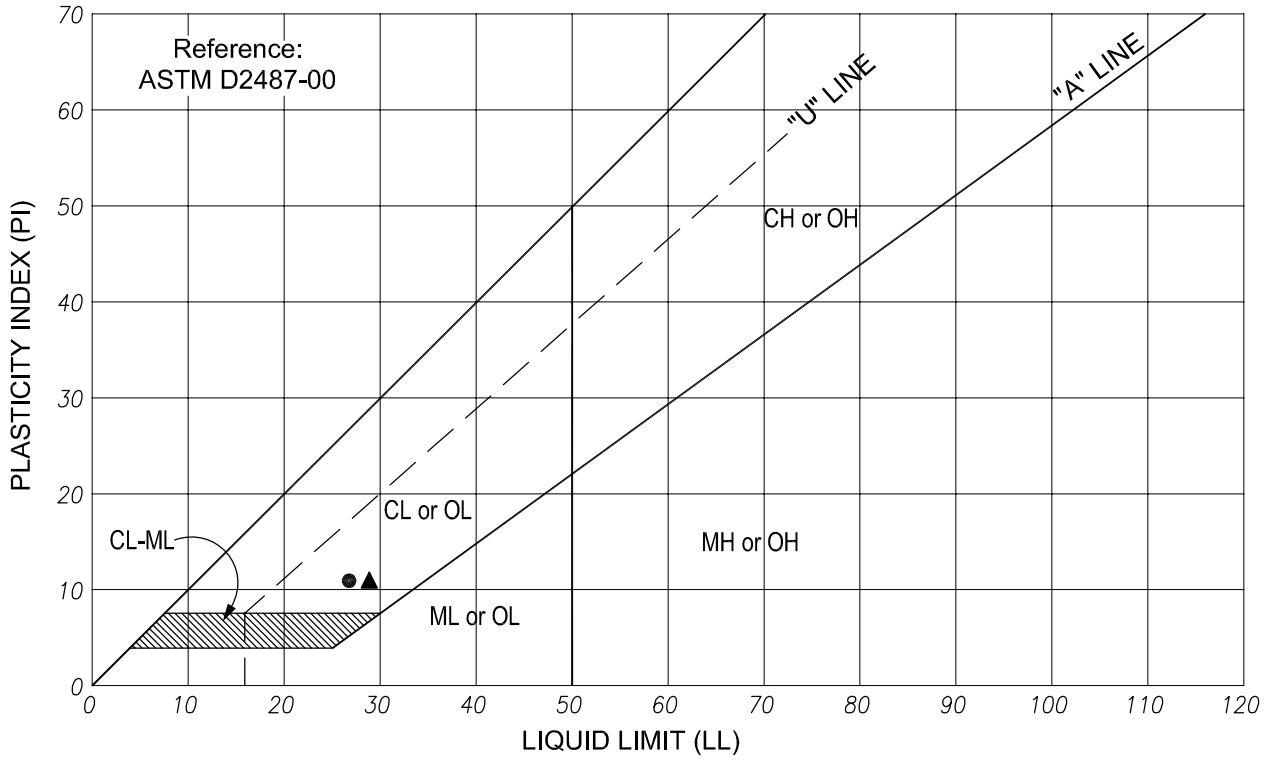
Land/ Marine Geotechnics

**ROCK CLASSIFICATION CRITERIA**

NCCWD Gypsy Hill Tank
Pacifica, California

Figure: **A-7**
Date: October 2005
Job Number: 105.005

# APPENDIX B
# LABORATORY TEST RESULTS




| Symbol | Source | Description & Classification | Natural M.C. (%) | Liquid Limit (%) | Plasticity Index (%) | % Passing #200 Sieve |
|---|---|---|---|---|---|---|
| ● | B-1 @ 3.5-ft | Yellow Brown Lean CLAY (CL) | 13.2 | 27 | 11 | |
| ▲ | B-4 @ 4.0-ft | Dark Brown Lean Sandy CLAY (CL) | 9.1 | 29 | 11 | |

Land/ Marine Geotechnics

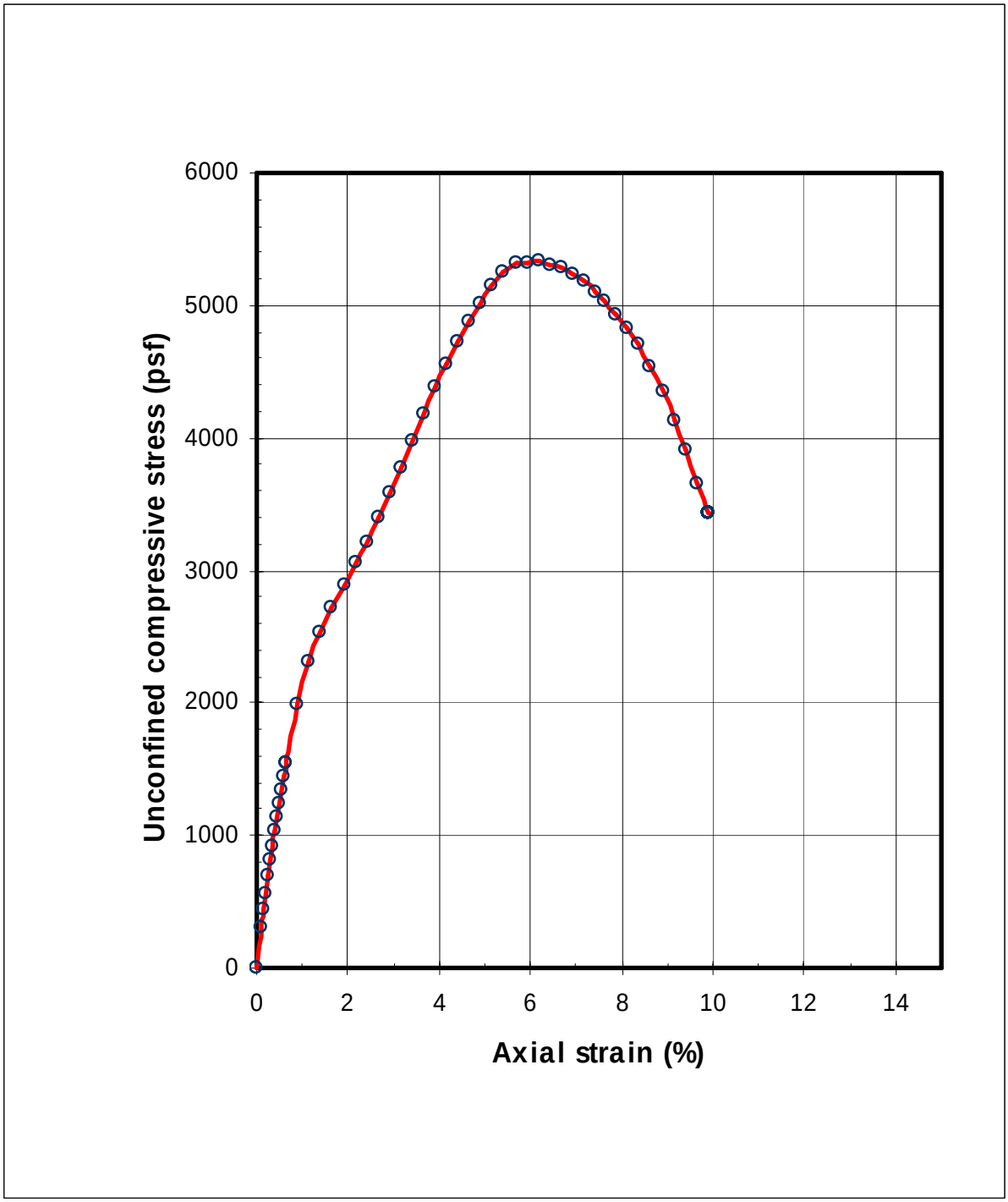
**PLASTICITY CHART**

NCCWD Gypsy Hill Tank
Pacifica, California

Figure: **B-1**

Date: October 2005

Job Number: 105.005




| | | | | | |
|---|---|---|---|---|---|
| Specimen Type | | | Undisturbed | Shear Strength (psf) | 2700 |
| Diameter (in.) | 2.42 | Height (in.) | 4.96 | Strain at Failure (%) | 6.2 |
| Moisture Content (%) | | | 13.2 | Strain Rate (in./min.) | 0.10 |
| Dry Density (pcf) | | | 119 | Confining Pressure (psf) | n/a |
| Source | | | B-1 at 3.5-ft. | Description | Brown CLAY (CL) with Gravel |

Land/ Marine Geotechnics

**UNCONFINED COMPRESSION TEST**

NCCWD Gypsy Hill Tank
Pacifica, California

Figure: **B-2**

Date: October 2005

Job Number: 105.005

# APPENDIX C
# SEISMIC HAZARD ANALYSIS

**Robert Pyke, Consulting Engineer**

August 28, 2005

R. William Rudolph
Land Marine Geotechnics
3388 Las Huertas Road
Lafayette CA 94549

Re: Gypsy Hill and Royce Tanks
Pacifica, California
Earthquake Ground Motions

Dear Bill,

At your request I have conducted seismic hazard analyses for horizontal ground motions at thess sites with a probability of exceedance of 10 percent in 50 years.

The Gypsy Hill site is located at Latitude 37.628 degrees and Longitude 122.479 degrees and is located approximately 1.7 kilometers from the San Andreas fault. The Royce site is located at Latitude 37.598 degrees and Longitude 122.485 degrees and is located approximately 4.1 kilometers from the San Andreas fault.

In order to obtain probabilistic response spectra I have conducted a formal probabilistic seismic hazard analysis using the hazard analysis procedure that was originally suggested by Cornell (1968) and is embodied in the computer program EQRISK, as described by McGuire (1976). The locations of the source zones and the assumed source zone parameters that were used are based on data presented by Petersen et al. (1996) and USGS (1999,2003). Since EQRISK models only areal sources rather than line sources, fault zones are normally modelled as strips having widths of about 2 km. However, in this case, because ground motions at the sites will be controlled by larger events on the San Andreas fault for which fault rupture must pass opposite the site regardless of the point of initiation and the length of the rupture, these zones were truncated to shorter lengths in order to force use of appropriate distances in computing spectral accelerations.

**1076 Carol Lane, Suite 136, Lafayette, CA 94549**
**Telephone 925/283-6765 Fax 925/283-7614 e-mail bobpyke@attglobal.net**

Further, since EQRISK otherwise assumes that the occurrence of earthquakes is randomly distributed in time, the activities assigned to the zones representing the larger earthquakes have been adjusted using a procedure suggested by Cornell and Winterstein (1988) in order to account for the date of last occurrence of major earthquakes on the San Andreas and Hayward fault systems, assuming a window of exposure of 50 years. For the Hayward fault it has been assumed that the Northern and Southern segments can rupture independently and the activity of the Northern segment has been increased to take into account the present uncertainty regarding the date of last rupture.

The attenuation relationships for 5 percent damped spectral acceleration on rock sites developed by Abrahamson & Silva (1997) and Sadigh et al. (1997) were used in the analyses. These relationships are currently being updated in a study co-ordinated by the Pacific Earthquake Engineering Research Center (PEER) that is referred to as the Next Generation Attenuation (NGA) study. Formal results from the NGA study are not yet available but preliminary results suggest that the new relationships may show lower spectral accelerations for periods less than 1 second particularly for faults like the San Andreas fault that exhibit surface rupture and have a high aspect ratio (the ratio of length to width (that is, the depth of the fault rupture)). Should the short period motions be critical to the project it may be possible to reduce them once the NGA study is completed but the date of the release of the formal results is presently uncertain (Maury Power, personal communication, July 18). Pending completion of the NGA study I have elected not to explicitly address forward directivity effects in my analyses. While some workers believe that these can be significant, work conducted for the New East Spans of the Bay Bridge in which I participated suggested that there is some uncertainty regarding these effects and I believe that it is adequately accommodated by the uncertainties that are already included in the analyses.

The 5 percent damped horizontal response spectra obtained using the Abrahamson and Silva attenuation relationship for soft rock and for 5 percent damping for a probability of exceedance of 10 percent in 50 years are shown in the attached Figure 1. Very similar values were obtained using the Sadigh et al. relationship but only the Abramhamson and Silva relationship is used in the subsequent calculations because it is defined by more points and extends to a period of 5 seconds. The values that are shown in Figure 1 out to 20 seconds were obtained by extrapolation at more or less constant displacement.

Spectral accelerations for 2 percent and 0.5 percent damping were obtained by multiplying the 5 percent damped values with period dependent multipliers that I have developed from study of acceleration time histories suitable for use in the San Francisco Bay region. Plots of the 5, 2 and 0.5 percent damped spectra are shown for the Gypsy Hill and Royce Tanks in Figures 2 and 3 respectively. The numerical values of the spectral accelerations used to generate these plots have been forwarded to you electronically.

It is now common that vertical response spectra be taken to have two-thirds of the spectral accelerations of the horizontal spectra, however, should vertical motions be critical I would recommend that, based on results obtained using the relationships for horizontal and vertical motions of Abrahamson and Silva (1997), the vertical spectra should be taken to be equal to the horizontal spectra up to a period of 0.15 seconds, drop linearly to be equal to one-half of the horizontal spectra at a period of 0.5 seconds, and remain at one-half the horizontal spectra at longer periods.

Please contact me should you or the project structural engineer have any questions.

Sincerely,

Robert Pyke, Ph.D., G.E.

**References:**

Abrahamson,N.A., and Silva,W.J., "Empirical Response Spectral Attenuation Relations for Shallow Crustal Earthquakes", Seismological Research Letters, Vol.68, No.1, January 1997.

Boore,D.M., Joyner,W.B., and Fumal,T.E., "Equations for Estimating Horizontal Response Spectra and Peak Acceleration from Western North American Earthquakes: A Summary of Recent Work", Seismological Research Letters, Vol.68, No.1, January 1997.

Cornell,C.A., "Engineering Seismic Risk Analysis", Bulletin of the Seismological Society of America, Vol. 58, No. 5, October 1968.

Cornell,C.A., and Winterstein,S.R., "Temporal and Magnitude Dependence in Earthquake Recurrence Models", Bulletin of the Seismological Society of America, Vol.78, No.4, August 1988.

McGuire,R.K., "FORTRAN Computer Program for Seismic Risk Analysis", U.S.Geological Survey, Open-File Report 76-67, 1976.

Petersen, M.D., et al., "Probabilistic Seismic Hazard Assessment for the State of California", California Division of Mines and Geology, Open-File Report 96-08, 1996.

Sadigh,K., Chang,C-Y, Egan,J.A., Makdisi,F., and Youngs,R.R., "Attenuation Relations for Shallow Crustal Earthquakes Based on California Strong Motion Data", Seismological Research Letters, Vol.68, No.1, January 1997.

U.S.G.S., "Earthquake Probabilities in the San Francisco Bay Region: 2000 to 2030 - A Summary of Findings", Open File Report 99-517, 1999. (WG99)

U.S.G.S., "Earthquake Probabilities in the San Francisco Bay Region: 2003-2032", Open File Report 03-214, 2003. (WG02)

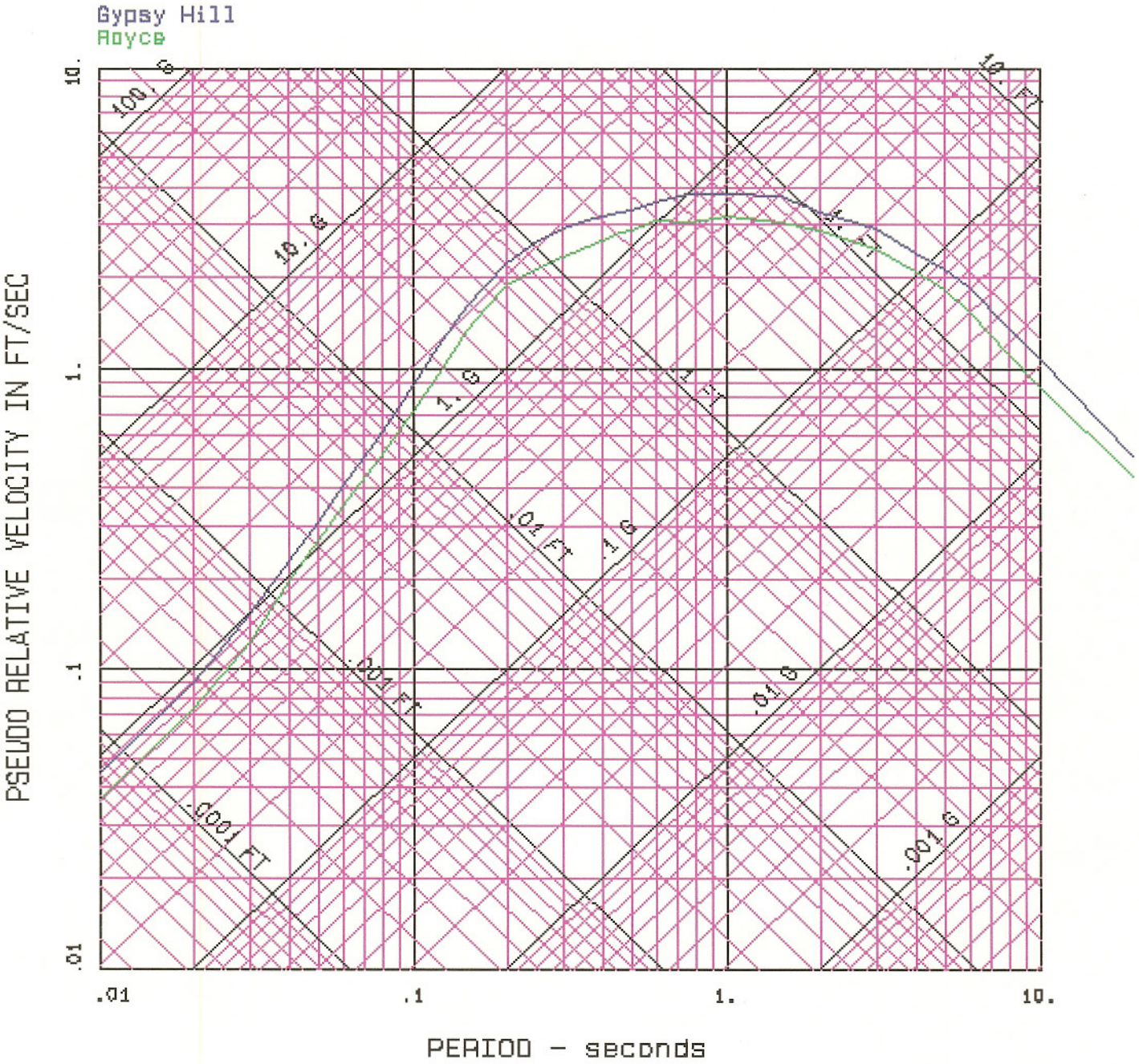



Fig.1 Gypsy Hill and Royce Tanks
5 Percent Damped Response Spectra

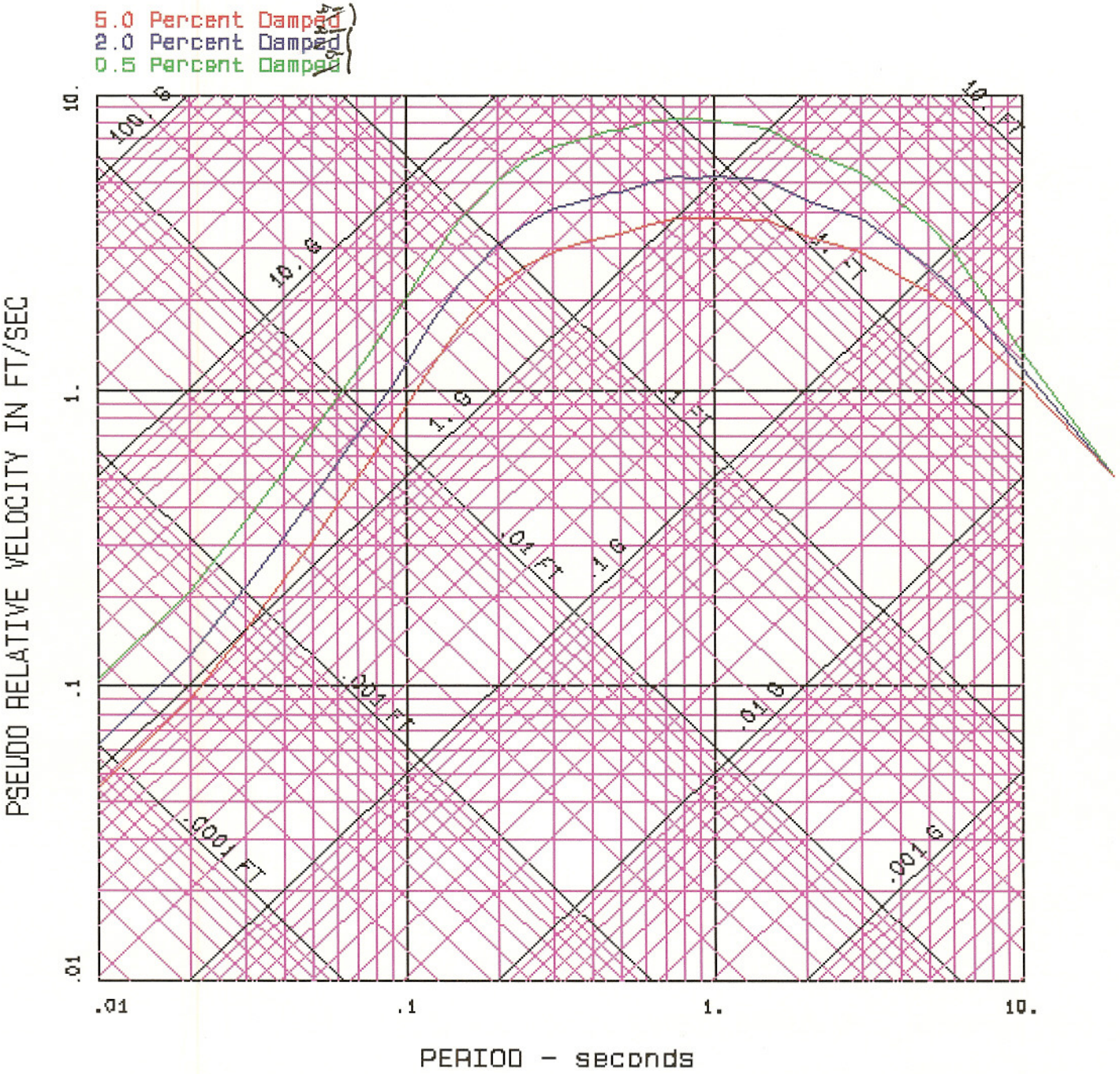



Fig.2 Gypsy Hill Tank
Elastic Response Spectra

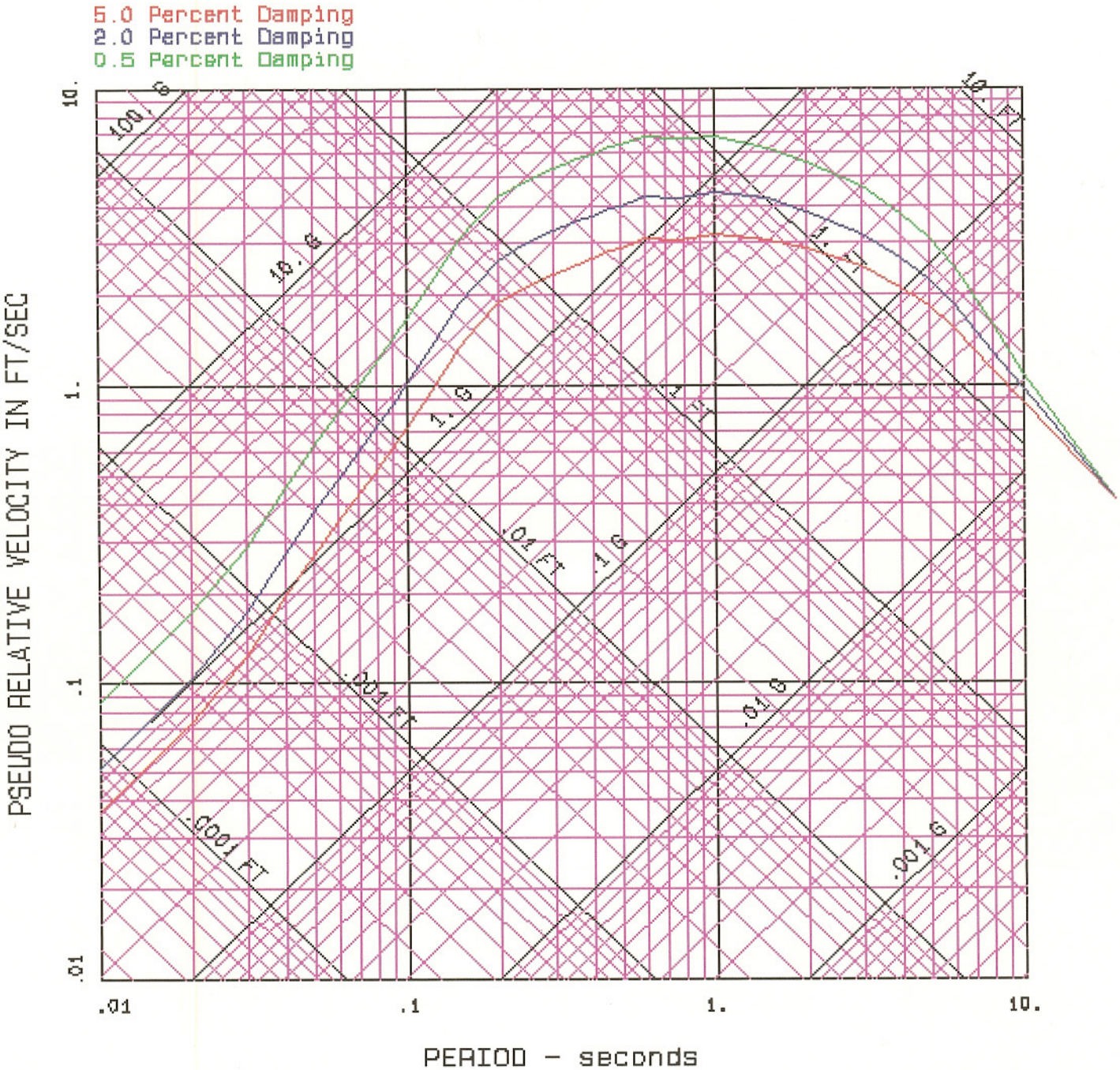



Fig.3 Royce Tank
Elastic Response Spectra

# NCCWD Pacifica Water Recycling Project
# Environmental Assessment

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## APPENDIX D
## The Treatment Technology Report for Recycled Water

STATE OF CALIFORNIA-HEALTH AND HUMAN SERVICES AGENCY GRAY DAVIS, GOVERNOR
DEPARTMENT OF HEALTH SERVICES
**DIVISION OF DRINKING WATER**
**TECHNICAL PROGRAMS SECTION**
**SANTA BARBARA**

# MEMORANDUM

DATE: June 24, 1999

TO: Toby Roy / Brian Bernados
San Diego District

FROM: Jeff Stone
Recycled Water Unit

SUBJECT: San Diego Unified School District
Unrestricted Landscape Irrigation

This memo is intended to address the issues raised under Concern Nos. 2 and 3 by the San Diego Unified School District (letter dated May 18, 1999) concerning the use of recycled water on local school grounds.

*CONCERN No. 2;*

First, let me provide some general comments concerning incidental contact and then I'll address the six bullet items listed. From the 'tone' of their letter, it would appear that safety concerns with respect to the use of tertiary - 2 2 recycled water for irrigation may have been misunderstood at the meeting held on May 5, 1999. The use-sites in question fall under the "unrestricted use" category for which tertiary-2.2 recycled water is required.

Currently allowed uses of recycled water under the unrestricted use category include (but are not limited to) body contact recreation, irrigation of food crops and irrigation of parks, playgrounds and schoolyards. The Department considers a properly filtered and disinfected water meeting the tertiary-2.2 requirements to be essentially pathogen free. As noted by Asano et al.[(1)], "To achieve efficient virus removal or inactivation in tertiary treatment, two major criteria must be met: 1) the effluent must be low in suspended solids and turbidity prior to disinfection to prevent shielding of viruses and chlorine demand, and 2) sufficient disinfectant must be applied to the wastewater". Treatment requirements determined necessary to meet the tertiary - 2.2 criteria outlined in Title

22 include effective filtration to reduce turbidity to less than a daily average of 2 NTU and disinfection to ensure a minimum CT of 450 milligram-minutes per liter at all times. This treatment scheme is intended to remove solids and properly prepare the water for effective disinfection and achieve an approximately five-log reduction of virus.

To provide a scientific basis upon which to evaluate the Title-22 Criteria, a virus risk analysis was conducted by Asano et al. [2]. Based on monitoring data from 424 secondary effluent samples and 814 tertiary effluent samples in California, risks associated with using recycled water were analyzed for golf courses, food crops, recreational impoundments, and groundwater recharge. Virus concentrations in recycled water after tertiary filtration and disinfection were less than 111 vu/100L and 99% of the time were less than the limit of detection of 1 vu/100L. At an enteric virus concentration of 1 vu/100L, the annual risk of polio- and echo-virus infection from exposure to tertiary – 2.2 water is estimated to be in the range of $10^{-2}$ to $10^{-4}$ for unrestricted recreational impoundments where swimming may take place. The probability of infection per year for a golfer who plays on a golf course irrigated with tertiary – 2.2 water is estimated to be in the range of $10^{-4}$ to $10^{-6}$.

It is noted that the $10^{-6}$ risk level is less than the limit recommended for potable water supplies of $10^{-4}$ (1 infection per 10,000 persons per year). Additionally, the Monterey Wastewater Reclamation Study for Agriculture (MWRSA) was a six year (1980-1986), $7.2 million field scale project designed to evaluate the safety and feasibility of irrigating food crops (many for eating raw) with tertiary – 2.2 recycled water. During this study, no enteric viruses were detected in the chlorinated effluent in either full treatment or alternative treatment processes. These studies are not necessarily definitive however, because the analytical technologies are not capable of detecting or enumerating all pathogens.

It is noted that the risk of infection is further reduced by:

- environmental barriers (die-off due to natural exposure to air, sunlight, etc.),
- treatment reliability requirements (multiple treatment units, alarms, automatic turnout capability, auxillary power, etc.),
- real time and routine monitoring requirements (contiuous turbidity and chlorine residual), and
- the numerous process and use-site controls (having the express intent of minimizing contact) typically required of any unrestricted landscape irrigation facility.

Current and proposed regulations which allow for unrestricted landscape irrigation incorporate stringent treatment and water quality requirements which are designed to be protective of public health. The turbidity and disinfection CT requirements outlined in our pending criteria are intended to achieve these objectives. In addition, it is noted that (as with any reuse project) use-site controls are incorporated into each project to further enhance the overall safety of the reuse application.

Comments Concerning Bulleted Items:

1. "Are damp areas (particularly in the morning) a health risk to children or the general public?" The treatment requirements for unrestricted access landscape irrigation (tertiary - 2.2) are intended to provide necessary public health protection for the intended reuse as noted above. Through the required filtration and disinfection processes, virus concentrations in the treated recycled water should be at a non-detectable level (less than one virus unit per 100 liters). It should be noted however that risk values addressed above do not necessarily take into account subgroups of the general population (i.e. children, elderly, immuno-compromised, etc.) that are at increased risk due to immune system development/status.

It is recognized that incidental contact with the irrigated landscape may occur. However recognizing the level and reliability of treatment required (which renders an essentially pathogen free water), coupled with use-site controls which should ensure against direct ingestion, the Department considers the re-use criteria to be adequately protective of public health. From a comparative standpoint, the use of tertiary treated - 2.2 recycled water for impoundments within which body contact recreation (swimming) is allowed, the application of such water on turf having unrestricted access poses a very low level of public health risk.

2. "If so, how damp is damp?" Use site control measures should ensure that recycled water applications do not exceed the percolative capacity of the turf. Requirements should be in place which prevent ponding and runoff, and provide for maximizing the time period between application and site use. A reasonable interpretation of the intent behind such controls would be that the use site is not soggy, although recognizing that the grass blades may quite likely be moist.

3. "If the area is damp, how is it determined whether it is caused by atmospheric conditions or irrigation?" If the area is irrigated with recycled water, it is safest to assume the moisture is attributable to this water and that all applicable use site precautionary measures are employed at all times.

4. "If for an example, reclaimed water was applied during the day to the field at the high school (for any reason) that the football team needed to practice on, how much time would it take before they were allowed to practice on the field?" The

minimum time period would be that which ensures that post irrigation turf conditions are not soggy (which can result in ponding during heavy use).

5. "A practice of all high school baseball coaches is to water down the infield for safety reasons. How will that practice be identified so it may continue?" It is assumed this is referring to the baselines, which are generally comprised of a clay/soil material. Sufficient time should have passed at which no puddling/ponding conditions remain. If this is not possible, use of a potable supply for this purpose is recommended. Also, I don't think we want to condone the idea of having hoses which convey recycled water laying around a ball field during active use. This is just one more of these use site control measures which should be addressed in use-site plan.

6. NA

*CONCERN No. 3;*

Bulleted Items:

1. "At what age has it been determined that contact with reclaimed water is not a risk?" The document entitled "Review of Health Risks Relating to Ingestion and Inhalation of Constituents of Reclaimed Water" (DHS 1992) states that children under eight years of age may not have acquired immunities to all illnesses that can be caused by the array of enteric viruses that might occur in municipal wastewater. However, it must be stressed that the level and reliability of treatment required for unrestricted landscape irrigation using recycled water is intended to result in an essentially pathogen free water delivered to the use site. Given this understanding, age should not be of significance, although further assessment work in this regard may very well be warranted. Restrictions imposed on lower order use sites where a lesser level of treatment is provided (e.g. Secondary 2.2 or 23) are necessary because it is recognized that the recycled water may not be pathogen free.

2. "If it's not acceptable, as an example, for a third grade student to be exposed to reclaimed water but, is determined that the risk is acceptable to a sixth grade student, how will this opinion be shared with the parents of the sixth grade student?" (See above).

3. "Within this context, please state the position of the meeting participants, in particular DEH and CSDWD of specific irrigation parameters?" I don't understand this question!!!!

4. "If daytime watering is not permitted, please state the position of the meeting participants on the operation of an irrigation seeding program or watering-in of fertilizer, which

may take place during daytime hours?" Use site controls would need to be developed which effectively exclude the public during the period(s) in question similar to any other application period. If this entails 'normal use periods', special measures may be needed such as lock-out and site supervision to exclude the public until the seeding or watering-in period ends.

Attachment (references)

SDUSD\699mem.doc

REFERENCES

1. Asano, T, Tchobanoglous, G, Cooper, R.C., "Significance of Coagulation-Flocculation and Filtration Operations in Wastewater Reclamation and reuse", in Symposium Proceedings, The Future of Water Reuse, Water Reuse Symposium III, San Diego, California, August 26-31, 1984. American Waterworks Association Research Foundation.

2. Asano T., Leong L. Y. C., Rigby, M. G., Sakaji, R. H., (1992) "Evaluation of the California Wastewater Reclamation Criteria Using Enteric Virus Monitoring Data", Water Sci. Technol., 26, 1513.

---

The following is a listing of reference materials which may provide more in-depth information concerning the health risks associated with the use of tertiary - 2.2 recycled water on parks, playgrounds and schoolyards.

1. Draft Statement of Reasons Relating to Risk of Exposure to Reclaimed Water, SDHS 12/10/92

2. Review of Health Risks Relating to Ingestion and Inhalation of Constituents of reclaimed water, SDHS 1992

3. Estimating the safety of Wastewater Reclamation and Reuse using Enteric Virus Monitoring Data, H. Tanaka, et al., 1998

4. Guidelines For Water Reuse, Chapter 2 Section 2.4, USEPA 1992

5. Microbial Risk Assessment For Reclaimed Water prepared for Irvine Ranch WD, EOA, Inc. 1995

6. Evolution of Tertiary Treatment Requirements in California, T. Asano, et al., Water Environment & Technology, Vol. 4, No. 2, February 1992.

7. Letter from SDHS (Gaston) to SWRCB, 9/27/79

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# NCCWD Pacifica Water Recycling Project
# Environmental Assessment

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## APPENDIX E
## Addendum to the MND for the Redwood City Recycled Water Project

# *Addendum to the Mitigated Negative Declaration for the*

# Redwood City Recycled Water Project

Prepared for

## The City of Redwood City

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# Contents

# Section 1 – Introduction

The City of Redwood City is considering the development and construction of a recycled water project that will provide a highly treated water supply for various uses in Redwood City. The recycled water project consists of infrastructure facilities to deliver recycled water from the South Bayside System Authority (SBSA) wastewater treatment plant to the Redwood Shores, Greater Bayfront, and Central Redwood City areas of the City. SBSA's recycled water meets stringent Title 22 environmental health requirements established by the California Department of Health Services (DHS) for unrestricted use of recycled water.

The Redwood City Recycled Water project represents a continuation of the "First Step Recycled Water Project," a pilot program initiated in spring 2000 by the City and SBSA. SBSA is a joint powers authority that provides wastewater treatment and disposal for the cities of Redwood City, Belmont and San Carlos, and the West Bay Sanitary District (serving Menlo Park, Atherton, Portola Valley, and parts of East Palo Alto). The First Step Project currently delivers recycled water to landscape irrigation customers at the eastern end of the Redwood Shores peninsula.

An Initial Study/Mitigated Negative Declaration (IS/MND) was prepared for the Redwood City Recycled Water Project. Pursuant to the provisions of the California Environmental Quality Act (CEQA), the City distributed the IS/MND for public review and comment from June 20 to July 20, 2002. The City received comment letters from four state agencies and one local business association; none of the comment letters raised significant environmental issues and, in accordance with CEQA, did not require responses. Prior to release of the IS/MND, the City conducted a public information workshop on the project on June 11, 2002. Two members of the public attended the meeting. No public comment letters from these citizens, or any others, were received on the IS/MND.

The Redwood City Planning Commission is responsible for adopting the MND before the City Council can take action on the project. The Planning Commission adopted the MND at its noticed public hearing on August 6, 2002. Two members of the public spoke in support of the project at that hearing. No one spoke in opposition. The Commission made the following findings in accordance with CEQA in its adoption action:

- The Mitigated Negative Declaration was completed in compliance with CEQA;
- Based on the record (including the Initial Study and comments received), there is no substantial evidence that the project will have a significant effect on the environment;
- A Mitigation Monitoring Plan for the project's mitigation measures was also adopted;
- The Mitigated Negative Declaration reflects the City's independent judgment and analysis.

Although the Commission's action on the MND was appealable to the City Council, no appeal was filed within the 10-day appeal period.

Subsequent to adoption of the MND by the Planning Commission on August 6, 2002, a greater interest in the project began to emerge from one of the citizens who attended the

June 11 public information workshop, as well as other members of the public. At its regularly scheduled meeting of August 26, 2002, the City Council reviewed and accepted the *Final Report of the Water Recycling Feasibility Study* for Redwood City, and also heard a presentation by Nelda Matheny (President, HortScience, Inc.) on *Landscapes Suitable for Irrigation with Recycled Water*. Several members of the public spoke on these items. The Council did not take action on the recycled water project at the meeting, but directed City staff to increase its public outreach and education efforts for the project.

Pursuant to City Council direction, a Public Information Forum was held for the recycled water project on September 16, 2002. A summary of the Forum is available at http://www.redwoodcity.org/water/index.html. Approximately 100 members of the public attended the meeting. Since then, public interest in the City's recycled water project has continued to remain high. As a result of this interest, the City has gathered research on and prepared several technical reports to address issues raised by the public about the recycled water project. The intent of these reports is to provide the public and the City Council with supplemental technical information about the project as it moves through the decision process.

The City has decided that these technical reports and other materials should be added to the CEQA documentation for the project. As indicated above, the Planning Commission has already adopted the MND for the project; however, the City Council has not yet taken an action on the project that would result in filing of the CEQA Notice of Determination (NOD). Therefore, the City has directed the preparation of this Addendum to the MND for the purpose of including this supplemental documentation into the CEQA record.

## Purpose of Addendum and CEQA Requirements

The purpose of this Addendum is to append supplemental technical information addressing issues raised by the public about the recycled water project, subsequent to adoption of the MND but prior to City Council action on the project. This document is prepared in accordance with Sections 15164 and 15162 of the State CEQA Guidelines.

Section 15164(b) of the CEQA Guidelines states:

> *An addendum to an adopted negative declaration may be prepared if only minor technical changes or additions are necessary or none of the conditions described in Section 15162 calling for the preparation of a subsequent EIR or negative declaration have occurred.*

Section 15162 (a) of the CEQA Guidelines provides that, for a project covered by a certified EIR or adopted negative declaration, preparation of a subsequent EIR or negative declaration rather than an Addendum is required only if one or more of the following conditions occur:

1. *Substantial changes are proposed in the project which will require major revisions of the previous EIR or negative declaration due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects;*

2. *Substantial changes occur with respect to the circumstances under which the project is undertaken which will require major revisions of the previous EIR or negative declaration*

*due to the involvement of new significant environmental effects or a substantial increase in the severity of the previously identified significant effects; or*

3. *New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete or the negative declaration was adopted, shows any of the following:*

    a. *The project will have one or more significant effects not discussed in the previous EIR or negative declaration;*

    b. *Significant effects previously examined will be substantially more severe than shown in the previous EIR or negative declaration;*

    c. *Mitigation measures or alternatives previously found not to be feasible would in fact be feasible and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or*

    d. *Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR or negative declaration would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measures or alternative.*

Section 15162(b) of the CEQA Guidelines states:

> *If changes to a project or its circumstances occur or new information becomes available after adoption of a negative declaration, the lead agency shall prepare a subsequent EIR if required under subsection (a) [above]. Otherwise the lead agency shall determine whether to prepare a subsequent negative declaration, an addendum or no further documentation.*

An Addendum to the MND is the appropriate CEQA document to address issues raised by the public subsequent to adoption of the MND because none of the criteria set forth in Section 15162(a)(1), (2), and (3) of the CEQA Guidelines have been triggered by the inclusion of this technical information. No changes to the recycled water project are being considered, and the information included in this Addendum does not create any new significant environmental effects, nor does it increase the severity of any previously identified significant effects. The changed circumstance under which the project is being undertaken involves the increase in public interest in the project subsequent to adoption of the MND. The City believes it is prudent to address these issues and include technical information about them in the CEQA record prior to making a decision on the project.

## Circulation and City Council Consideration of Addendum

Although circulation for public review of an Addendum is not required under CEQA (Guidelines Section 15164{c}), the City has determined that it is beneficial and important to the public discourse and understanding of the project that the material contained in this Addendum be provided to the citizens of Redwood City and the general public. Thus, this Addendum is being circulated for public review for a 28-day period. Written comments on this document may be submitted to the City through June 9, 2003 at the following address:

Public Works Services Department
1400 Broadway
Redwood City, CA 94063

It is anticipated that the City Council will take action on the recycled water project in the July-August, 2003 timeframe. In accordance with CEQA Guidelines Section 15164(d), the Council will consider the Addendum with the adopted MND prior to making a decision on the project.

*For additional copies of this Addendum, call Public Works Services at (650) 780-7464, or download files from the City's website:* http://www.redwoodcity.org/water/index.html

# Section 2 – Contents of Addendum

## Previous Environmental Documentation

As indicated in Section 1, an IS/MND for the recycled water project was prepared and circulated for public review, and was adopted by the Planning Commission on August 6, 2002. The Planning Commission staff report and minutes from the meeting of August 6, 2002 are included in this Addendum as Appendix A. The IS/MND is not included with this Addendum, but can be obtained at City Hall (office of the City Clerk, 1017 Middlefield Road, Redwood City) or from the City's website: http://www.redwoodcity.org/water/index.html.

## September 16, 2002 Public Information Forum

Many of the public's issues and concerns about the project were raised and discussed at the September 16, 2002 Public Information Forum conducted by the City Council. A summary of the Forum is available at http://www.redwoodcity.org/water/index.html. VHS video tapes of the forum are also available at the Redwood City Main Library, Reference/Information Desk.

## Issues Responded to in the Addendum

Based on its review of the IS/MND and issues raised at the September 16, 2002 Public Information Forum and subsequent meetings, the City has determined that technical information about two primary issues should be included in this Addendum: 1) Water quality and public health, and 2) Recycled water quality and intended uses. In addition, a section on the City and SBSA's water quality assurance program is included in this Addendum. These items are addressed in Sections 3, 4, and 5, respectively, of this Addendum.

# Section 3 – Water Quality and Public Health

## Definitions of Water Sources

For purposes of understanding the different types and qualities of water sources, the following definitions are provided with respect to Redwood City's current water supply setting.

**Potable Water Supply -** Water meeting the minimum requirements of the United States Environmental Protection Agency (U.S. EPA) and additional requirements of the State of California Department of Health Services (DHS) for drinking water. In Redwood City, 100% of the potable water supply is provided by through contract agreement with the City and County of San Francisco via the San Francisco Public Utility Commission (SFPUC), operator of the Hetch Hetchy regional water system. This water supply is widely considered to have very high water quality, probably within the top three water systems in the entire United States.

**Wastewater –** After water is used for municipal or industrial purposes it becomes wastewater. In Redwood City, wastewater is generated primarily by residential, commercial and office land uses, with very small contributions from light manufacturing and hospital uses. This wastewater source is typical of wastewater generated from an urban, residential based community. Wastewater is treated to the requirements of the State of California's Regional Water Quality Control Board (RWQCB) for protection of the environment and drinking water supplies. In Redwood City, SBSA is responsible for treating the City's wastewater and discharging the treated effluent to the San Francisco Bay. Because discharges to the San Francisco Bay are further regulated under the California Toxics Rule, SBSA provides even higher levels of treatment than typically required for wastewater, providing removal of heavy metals and other constituents. SBSA provides primary and secondary treatment followed by disinfection to remove solids, pathogens, viruses and other regulated and non-regulated contaminants before wastewater is discharged to the San Francisco Bay. Primary treatment is a physical process that removes suspended solids and most organic matter. Secondary treatment is a biological process that uses microorganisms to remove residual organic matter and suspended material. Disinfection kills pathogens and viruses.

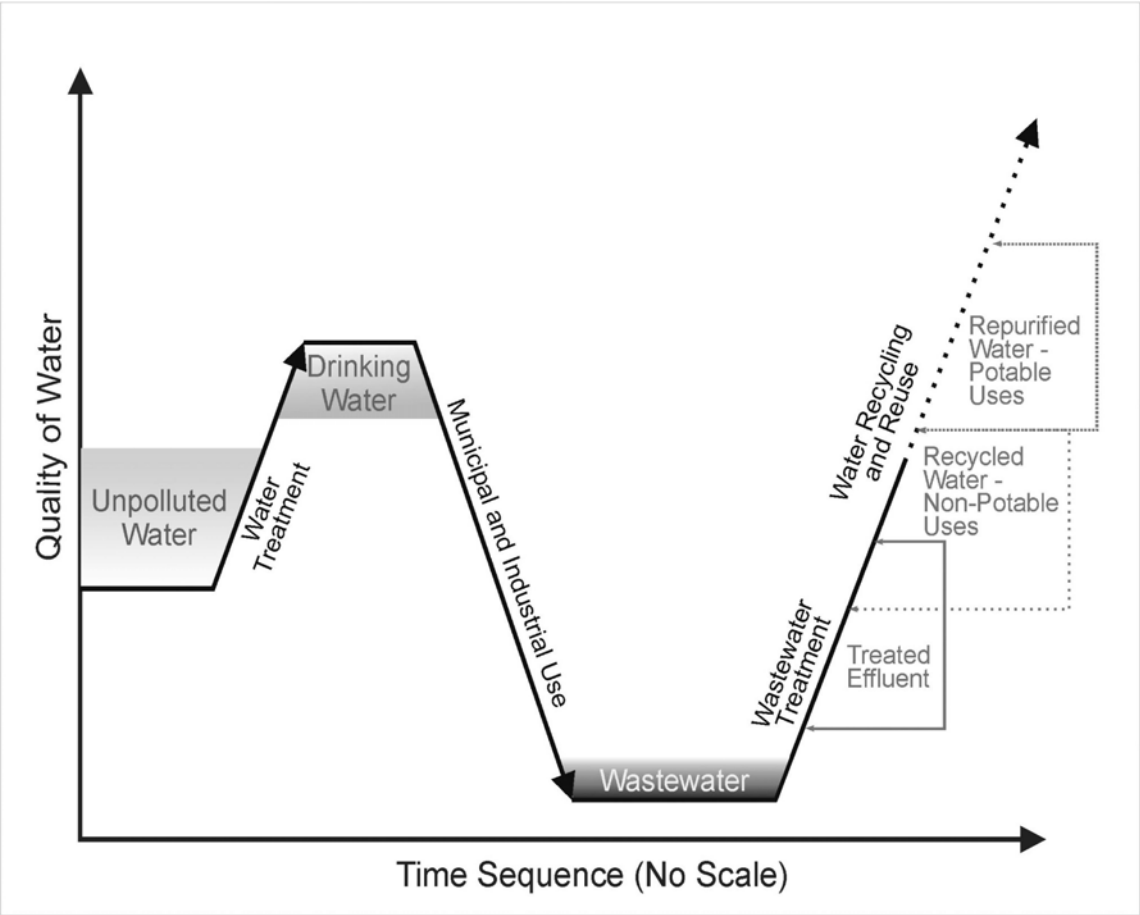
**Treated Effluent –** After wastewater is treated it becomes treated effluent, suitable for discharge to the environment. The SBSA outfall pipe is located approximately 6,000 feet off shore, 3.5 miles south of the San Mateo Bridge, in the deep water ship channel.

**Recycled Water –** Recycled water is produced from treated effluent, after several additional treatment steps are provided. Recycled water is also regulated and must comply with the minimum requirements of Title 22 California Code of Regulations, which is administered through the DHS and the RWQCB, the same entities that are responsible for protection of drinking water supplies and the environment. For purposes of Redwood City's proposed Recycled Water Project, recycled water would be produced at SBSA following additional tertiary treatment and disinfection steps as required to meet specific requirements for

beneficial uses. This additional treatment includes the addition of chemicals and coagulation to effectively remove very fine suspended particles through direct filtration. In addition, a higher level of disinfection is provided using chlorine, the same chemical used for disinfecting drinking water supplies. Recycled water has significantly higher water quality than treated effluent. According to the California Water Code, Section 13050(n): "Recycled water" means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource.

**Graphic Summary -** Figure 1 depicts water quality changes during municipal uses of water relative to levels of treatment.

## Figure 1 – Understanding the Relative Quality of Water Sources




**Source:**
Water quality changes during municipal uses of water in a time sequence and the concept of water recycling (Asano, T., *Water Science & Technology*, Vol. 45, No. 8, p. 29, 2001.)

**Kennedy/Jenks Consultants**

Redwood City
Recycled Water Project

**Understanding The Relative Quality Of Water Sources**

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April 2003

**FIGURE 1**

## Regulatory Requirements for Safe Operation of Recycled Water Projects

Recycled water in Redwood City is intended for specific non-potable uses as permitted under Title 22 California Code of Regulations, Division 4, Chapter 3 - Water Recycling Criteria, Article 3 - Uses of Recycled Water (March 20, 2001). These regulations set the requirements for the protection of public health and safety related to recycled water use. Refer to Figure 2 for a summary of these regulations. For each permitted use (i.e., irrigation, impoundments, cooling and other purposes), the specific level of treatment and water quality requirement is defined that must be met to achieve safe use and compliance with DHS and RWQCB regulations. In Title 22, there are four classifications for the level of treatment. Listed in order of lowest water quality to the highest water quality, these classifications include:

- Undisinfected Secondary Recycled Water
- Disinfected Secondary 23 Recycled Water
- Disinfected Secondary 2.2 Recycled Water
- Disinfected Tertiary Recycled Water

Of these classifications, Disinfected Tertiary Recycled Water in the State of California requires the highest level of treatment and establishes the most restrictive water quality requirements for any recycled water source in the United States. SBSA currently produces this level of disinfected tertiary recycled water for the First-Step Recycled Water Project that has been in operation for three years in Redwood Shores. This water is suitable for every use listed in Figure 2, without restriction, including irrigation of edible food crops.

Relevant definitions from the California Department of Health Services for "disinfected tertiary recycled water" are as follows:

> **60301.230. Disinfected tertiary recycled water**
> "Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater that meets the following criteria:
> (a) The filtered wastewater has been disinfected by either:
>
> (1) A chlorine disinfection process following filtration that provides a CT (the product of total chlorine residual and modal contact time measured at the same point) value of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or
>
> (2) A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.

(b) The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30 day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

**60301.320. Filtered wastewater**
"Filtered wastewater" means an oxidized wastewater that meets the criteria in subsection (a) or (b):

(a) Has been coagulated and passed through natural undisturbed soils or a bed of filter media pursuant to the following:

(1) At a rate that does not exceed 5 gallons per minute per square foot of surface area in mono, dual or mixed media gravity, upflow or pressure filtration systems, or does not exceed 2 gallons per minute per square foot of surface area in traveling bridge automatic backwash filters; and

(2) So that the turbidity of the filtered wastewater does not exceed any of the following:

(A) An average of 2 NTU within a 24-hour period;

(B) 5 NTU more than 5 percent of the time within a 24-hour period; and
*California Health Laws Related to Recycled Water June 2001 Edition Title 22*

(C) 10 NTU at any time.

(b) Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:

(1) 0.2 NTU more than 5 percent of the time within a 24-hour period; and

(2) 0.5 NTU at any time.

**60301.650. Oxidized wastewater.**

"Oxidized wastewater" means wastewater in which the organic matter has been stabilized, is nonputrescible, and contains dissolved oxygen.

The SBSA treatment process utilizes the dual biological "secondary treatment" process of trickling filters and activated sludge to produce the "oxidized wastewater". The oxidized wastewater is then filtered through gravity-fed dual media filters. The filter media is comprised of a 12" layer of supporting gravel, a 12" layer of sand and a 24" layer of anthracite filter coal. In the First Step Recycled Water project, the oxidized filtered water is disinfected with sodium hypochlorite in a dedicated chlorine contact system before being pumped to the distribution system or to storage. It is anticipated that sodium hypochlorite will also be used in the Redwood City Recycled Water Project.

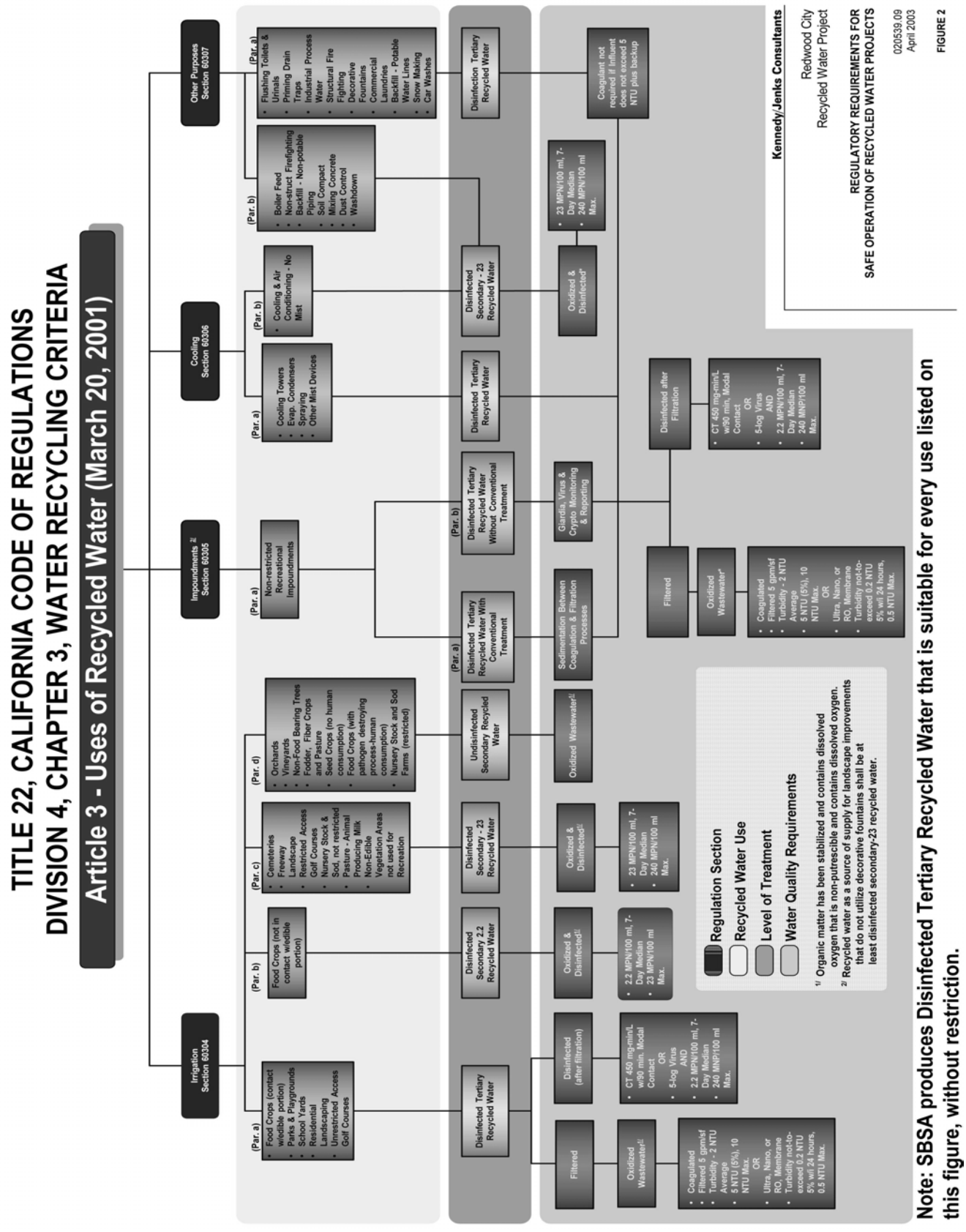
## Intended Purpose and Use of Recycled Water in Redwood City

Recycled water is intended to be a source of drought-proof, non-potable water supply in Redwood City. As described in the IS/MND, the *Final Report for the Water Recycling Feasibility Study for Redwood Shores* (Kennedy/Jenks Consultants, January 2002), and the subsequent *Final Report for the Water Recycling Feasibility Study for Redwood City* (Kennedy/Jenks Consultants, August 2002), a recycled water project can be implemented that will supply approximately 1,950 acre feet per year (AF/yr) of water for various non-potable uses. In combination with passive and active water conservation efforts it is anticipated that the City can reduce its current 1,000 AF/yr overdraft on the Hetch Hetchy regional water supply and provide sufficient water supply for the City's planned growth through the year 2020.

The proposed Recycled Water Project would include the following non-potable uses identified previously in Figure 2:

- **Irrigation –** the largest use of recycled water will be for irrigation of parks and playgrounds, schoolyards, residential landscaping, and street/highway landscapes.
- **Impoundments –** some recycled water could be used for landscape impoundments at the SBSA site or other sites in the future. ("An impoundment is defined in Title 22 as "An impoundment in which recycled water is stored or used for aesthetic enjoyment or landscape irrigation, or which otherwise serves a similar function...")
- **Cooling –** some recycled water could be used for cooling purposes in existing or new commercial/office buildings.
- **Other Purposes –** recycled water could be used for other purposes such as construction water for backfill and soil compaction, street and walkway wash down, dust control, concrete mixing, internal toilet flushing in new commercial/office buildings, and in decorative fountains.

## Figure 2 – Regulatory Requirements for Recycled Water Projects



## Redwood City / SBSA First Step Recycled Water Project

As stated on page 3 of the IS/MND, the proposed Redwood City Recycled Water Project represents a continuation of the "First Step Project," a pilot recycled water project initiated in spring 2000 by the City and SBSA. SBSA operates a publicly owned wastewater treatment plant at the eastern end of the Redwood Shores peninsula. These facilities produce a high level of wastewater treatment, as required by regulatory agencies for the discharge of effluent to the San Francisco Bay. The RWQCB encouraged SBSA to take a leadership role in developing a pilot water recycling project concurrent with the Board's approval of SBSA's Stage 2 Wastewater Treatment Facilities Expansion project in 1997.

The First Step Project is currently in operation, and consists of temporary treatment facilities and permanent underground pipelines that deliver recycled water to landscape customers at the eastern end of the Redwood Shores peninsula near the SBSA plant. The eastern end of Redwood Shores has existing dual water piping facilities that were installed in the streets as part of residential and other development since the mid-1980s. The intent of the project has been to demonstrate the feasibility of producing recycled water at SBSA that meets California's Title 22 environmental health requirements for disinfected tertiary recycled water established by the DHS, while using it successfully in the community, primarily for landscape irrigation. The project was designed with the intent of providing recycled water for two years, using the existing temporary facilities with minimal modifications. The First Step Project has been successful in demonstrating use of recycled water, and has been extended two more years. It will operate through the 2003 irrigation season. A Categorical Exemption (CE) for the First Step Project was prepared in accordance with CEQA statutes and guidelines in October 1999, with SBSA as the Lead Agency and the City as Responsible Agency.

## Safety Record of Recycled Water Projects in California

According to the *California Municipal Wastewater Reclamation Survey*, May 24, 2000, by the Office of Water Recycling, California State Water Resources Control Board, 402,000 AF/yr of recycled water was being used in California at that time (see Appendix B). The May 2003 final report, *Recommendations of California's Recycled Water Task Force – Water Recycling 2030* is (available on the State website at www.owue.water.ca.gov/recycle/taskforce/taskforce.cfm) states "Currently, California is recycling approximately 500,000 acre-feet of water per year for various uses." The report points out that by 1952, 107 California communities were using recycled water for agricultural and landscape irrigation. In its letter of transmittal to the State legislature, the Task Force makes the statement, "The Task Force believes that the recommendations in this report will improve the status of recycled water in the State. We are convinced that it is possible to substantially advance the safe use of recycled water, and we look forward to helping you implement the recommendations."

The 40-member Task Force was created and formed when the Governor signed Assembly Bill 331 into law in October 2001. Over the 12 months that the Task Force was active, it identified and adopted 25 issues with respective recommendations to address obstacles, impediments, and opportunities for California to increase its recycled water usage. Not one of the issues identified was related to the need for changes in protection of public health for

recycled water uses under consideration in Redwood City. However, several of the Task Force recommendations do address the need for more public education and awareness. Only potential indirect potable use in other parts of the State was determined to require a recommendation.

There is no data indicating that the proper use of recycled water for intended purposes has caused any illness or compromised human health in California. As discussed in subsequent pages of this section, there are no data indicating that the use of recycled water from the SBSA wastewater treatment plant for landscape irrigation in urban areas will present a health risk to humans.

## Representative Recycled Water Projects

The proposed Redwood City Recycled Water Project is similar to other recycled water projects that have been successfully operated for up to twenty years in the San Francisco Bay area. Several representative projects were reviewed and compared to the proposed Redwood City Project. The representative projects were selected because their location, climate type, land use, wastewater source, level of wastewater treatment, level of tertiary treatment, and recycled water uses are nearly identical to those in Redwood City. The representative project comparison is summarized in Table 1.